DOCUMENT RESUME

ED 229 445 TM 830 353

AUTHOR	Oltman, Philip K.
TITLE	Cognitive Assessment and the Media.
INSTITUTION	College Entrance Examination Board, New York, N.Y.
REPORT NO	CB-R-83-1; ETS-RR-83-10
PUB DATE	83
NOTE	11p.
AVAILABLE FROM	College Board Publications, Box 886, New York, NY 10101. ($5.00)
PUB TYPE	Viewpoints (120)
EDRS PRICE	MF01 Plus Postage. PC Not Available from EDRS.
DESCRIPTORS	Cognitive Ability; *Cognitive Measurement; *Computer Assisted Testing; Educational Media; Information Theory; Literacy; *Mass Media; *Media Research; Standardized Tests; *Television; Use Studies
IDENTIFIERS	Test Score Decline

ABSTRACT

Focusing on the cognitive consequences of the present-day media environment and on the possible implications for cognitive assessment of these consequences, the information environment is discussed concerning the nature of its symbol system and electronic media. Also discussed are the information processing demands of television, the media and culture, using media to cultivate mental skills, cognitive assessment and the media, and media competence. Finally, assessment via the media is explored as to : (1) increasing the face validity of items dealing with processes; (2) testing interpersonal skills; (3) testing the handicapped, and (4) presenting novel and ill-structured problems. The author feels that research and development are now at the stage at which projects can be proposed that exploit more fully the technological tools at hand in ways that will make cognitive assessment more comprehensive. (Author/PN)

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College Board Report

No. 83-1

Cognitive Assessment and the Media

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Educational Testing Service

College Board Report No. 83-1

ETS RR No. 83-10

College Entrance Examination Board, New York, 1983

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ABSTRACT

The present-day information environment is heavily saturated with electronic media. What are the properties of these media, and how does massive exposure to them affect the cognitive functioning of the audience? These and related issues are reviewed, and some implications for cognitive assessment are suggested.

INTRODUCTION

Students approaching college age have spent more time viewing television than attending school, playing, or doing anything else except sleeping (Schramm, 1977). Generally, it is agreed that the electronic media have become the dominant mode of communication in our society, having displaced print in the "ecology" of our information environment. What are the cognitive consequences of this electronic revolution? According to Eisner (1978), when particular kinds of expressive forms are dominant in a culture, people tend to do their thinking in those forms of expression. Certainly a great deal is being learned from those many hours of television exposure, and it is being learned via a medium whose symbol system is very different from those of print or the classroom. As Mielke (1970) points out, the visual mode of television may increase learning in ways that are not detected in the standardized tests currently employed, and as others have claimed, it may have a negative effect on skills that are currently being assessed. The present discussion will focus on the cognitive consequences of our present-day media environment, and on the possible implications for cognitive assessment of these consequences.

THE INFORMATION ENVIRONMENT

According to Postman (1979), to understand the effects of media, we must think of the multitude of information inputs surrounding us as an environment that can be studied as an ecological system. Just as the physical environment determines what we eat and what kinds of work we must do, so the information environment shapes the kinds of ideas, attitudes and values, and intellectual capacities we develop. In Postman's view, the word-centered and concept-centered communication mode of the school is now dominated by the image-centered and analogic mode of television. To understand the nature of the conflict between the communicative modes of school and television, it is essential to focus on the *symbol system* as that aspect of any information medium that is most important in determining its cognitive effects.

The Nature of Symbol Systems

Any object, movement, gesture, mark, or event can serve a symbolic function when it represents, denotes, or expresses something beyond itself. A symbol system exists when a set of symbols is correlated with a field of reference. Thus, the symbol systems of media are their "ways of structuring and presenting information" (Salomon, 1979, p. 216). A medium is a particular technology plus the symbol system that develops in association with it. The psychologically relevant part is the symbol system, not the hardware. To be most precise, we should refer to our topic of discussion as the cognitive consequences of symbol systems, not of media.

Any given medium, be it print, radio, or television, is not simply an envelope in which to send a message; it is itself a major part of that message. Changing the medium does not leave the enclosed message unchanged. As Postman (1979) says, the printing press, the computer, and the television are not simply machines that convey information. Like language, they are different windows on the world, each with its own optical properties. Each medium's peculiar refractions are due to the properties of its symbol system.

If different symbol systems have different cognitive consequences, what attributes of symbol systems are influential in producing those consequences? Salomon (1979) points out that different media are suitable for conveying different kinds of content. For example, video or film is particularly apt for conveying movement or the interplay of forces. Furthermore, symbol systems differ in the amount of mental translation required to convert an external depiction into an internal representation. For example, television viewing does not require elaborate cognitive skills and does not need to be taught. Watching television is primarily direct pattern recognition that both young and old can readily accomplish without instruction. On the contrary, print requires lengthy training and considerable practice to accomplish the complex series of decodings required to produce meaning. Further, symbol systems differ in the kinds of mental skills they invoke in translation. To the extent that symbol systems require more or less mental translation, and to the extent that the skills invoked during the translation to an internal representation differ qualitatively, the knowledge acquisition outcomes can be expected to vary as well.

Salomon (1979) makes the further distinction between knowledge outcomes and mental skill outcomes. Obviously, the contents of messages affect the kind of knowledge acquisition attained, whereas the symbol system of the medium delivering the message affects the nature of the mental skills that are activated and cultivated. The latter is the crux of this discussion: How has the modern media environment affected the pattern of mental skill development in the population?

Electronic Media in the Information Environment

One way to emphasize the salience of electronic media in the information environment is to consider how much they displace other activities in people's lives. In the case of television, we know from a large number of time-use studies

that children now think of it as their favorite medium, with the result that they spend less time with other media and in other activities. They go to bed later, are less likely to be read to by their parents before they themselves learn to read, spend less time reading when they do learn to read, and spend less time playing with other children away from their own homes (Schramm, 1977). Heavy exposure to television results in a great deal of incidental learning, but not generally of a kind that contributes to scores on achievement tests in reading or mathematics. As Schramm (1977) summarizes, "Children are now getting 15 to 20 hours a week more practice in learning from pictures than they used to, and a little less practice in learning from print."

Television has been characterized as a "plug-in drug" (Winn, 1977). Although a great deal has been written about the effects on the young of television content, with its unrealistic portrayals of sex, violence, and simplistic human relations, it appears that the most important effects are due to the medium itself and not to the messages it carries. In fact, better content would encourage more viewing, with its displacement of other activities, encouragement of passivity, and even addict-like behavior. Winn claims that television viewing may establish a pattern of nonlinguistic cognition to the detriment of the linguistic mode of reading.

THE INFORMATION-PROCESSING DEMANDS OF TELEVISION

From a cognitive viewpoint, in what ways does television viewing differ from reading? By examining some of the differences in the cognitive processes invoked, we may be better able to assess the impact of media exposure. One major difference is that more self-generated imagery occurs in reading than during television viewing, in which the images and sounds must be taken as they are given. According to Kerns (1981), the bisensory (visual and auditory) nature of the television stimulus leaves less freedom for individual mental elaboration than does print, sound alone, or vision alone. Reading requires concentration to carry out the complex decodings necessary to achieve meaning, whereas television is attended automatically, even in the absence of comprehension (Schwartz, 1973). In reading, the reader controls the pace, whereas in television the pace is fixed; the viewer must watch what is on at a certain time where there is a set and cannot question or elaborate upon the content with much freedom.

Postman (1979) sees one result of the modern information environment as the "rapid emergence of an all-instant society: Instant therapy, instant religion, instant food, instant friends, even instant reading" (p. 76). We become accustomed to television's instant mode of information transmission that requires no prerequisites and can be decoded with little effort by children and adults alike. In Postman's view, this cognitive mode needs to be balanced by a counteracting force from schools emphasizing the linear, logical mode of print. As McLuhan (1965) said, "Just as we now try to control atom-bomb fallout, so we will one day try to control media fallout. Education will become recognized as civil defense against media fallout" (p. 305). What should be taught now is what students do not get from the ambient information environment. To the extent that the information environment is image-centered, it must be countered by an education that stresses language and its accompanying logical thought processes.

MEDIA AND CULTURE

In an essay entitled, "The Day Our Children Disappear," Postman (1981) advances the view that we are now in the midst of a decline in the concept of childhood, primarily because of the influence of television on our culture. As background for his argument, he cites the views of Socrates, who railed against the introduction of a new medium in his time, the written word. He felt that writing would undermine the oral tradition by weakening the Athenians' memories, by promoting passive acceptance of written argument rather than active participation in it, and by destroying the concept of private discourse (since the written word could be read by unauthorized persons).

Socrates was partly correct, in that the introduction of writing did produce profound cultural changes. Until the printing press emerged, however, reading and writing were limited to a few individuals. Most people had no need to read, and childhood was considered to end when full competence in speech was developed. After about the age of seven, the person was considered more or less adult because he or she was capable of learning through the same medium—face-to-face interaction—used by fully grown adults. The introduction and spread of the printing press changed European culture into a reading culture and made it necessary for people to learn to read before they could be considered adults. Thus, beginning in the sixteenth century, the young had to be taught to read, and they were therefore set apart from the rest of society in institutions (schools) that were set up to teach them to read and become adults.

The segregation of the young into schools established the state of childhood as a special and recognized stage of development. Children were people who did not know how to read yet, and hence they could not know what adults needed to know. Today, after several hundred years of developing and refining our conception of childhood, the new medium of television enters the scene with "a transforming power at least equal to that of the printing press and possibly as great as that of the alphabet itself" (Postman, 1981, p. 384). Because television requires no instruction to decode its messages and, therefore, does not restrict its audience by age, the dividing line between what children know and what adults know is dissolving. Television communicates the same information to everyone, regardless of age, sex, race, or level of education, and thus the innocence and special nature of childhood is disappearing. The content of television itself reflects this change, with the appearance of

adult-like children and child-like adults both in programming and advertisements. One institution most particularly threatened by this trend is the school, whose basic assumption is that children are different from adults and that adults have something of value to teach to children.

In contrast to these gloomy views that characterize television and other media as a sort of electronic plague set upon us, other commentators see more positive trends in the modern media environment. Arnheim (1974) holds that all thinking is basically and primarily imagistic and is based on visual perception, with language serving as a "mere auxiliary" to the primary vehicle of thought. If this were so, television would more directly fit the nature of the human cognitive mechanism than would print. Some advocates of the film literacy movement go so far as to conclude that, since children watch movies and television and no longer read books, we should teach film instead. At one level, this is done by using the attention-getting and attention-sustaining properties of commercial television to make school time more palatable to the television generation of pupils (Potter, 1981). However, media can also be studied in a way calculated to raise students' consciousness about its effects on them, not "just as a new kind of basket-weaving substitute for grammar or physics" (Houk and Bogart, 1974, p. 15). In this view, thinking consciously about a medium, and not just about its content, will diversify and deepen the students' insights.

USING MEDIA TO CULTIVATE MENTAL SKILLS

Salomon (1979) presents an interesting analysis of the possibilities of media use in education that emphasizes what media's effects can be, rather than what they usually are. Understanding the content of any medium requires recoding the stimulus into an internal representation, and subsequent mental elaboration to connect those representations to existing structures. As it usually occurs, television viewing requires little mental elaboration for understanding; the recoding skills necessary to extract meaning are well automatized even for very young children. The differences between reading print and viewing television can be shown empirically in various ways. For example, children asked to recall a story showed evidence of greater mental elaboration and association to their own experience when they had read the story than when they had viewed it on television (Meringoff, 1978). In comparing brain activity during television viewing and during reading, Krugman (1971) found greater brain electrical activation during reading than during television viewing. Commenting on these studies, Salomon (1979) points out that television *allows* more shallow mental processing but in no way *requires* it. That is, the effect of a medium's symbol system on an individual's cognitive makeup depends upon what kinds of recoding and elaboration are applied to the input, and these in turn depend upon the task to be performed. Concentration is an indispensable skill in reading, but in television viewing concentration is usually unimportant because of the automatic attention-getting nature of the television mode. However, nonautomated skills can be called upon and cultivated through the television and film media, as Salomon has demonstrated.

By using active exposure to the unique symbol system of film, Salomon has shown that a number of spatial visualization abilities can be cultivated. The tasks of changing perspective, visualization, detecting items in a crowded display, and figure-ground separation can be taught and skills in them improved by the unique capability of the symbol systems of video and film to depict and model these visual processes. For example, the use of zoom displays can increase figure-ground discrimination, split-screen displays can train mental comparisons, visual unfolding of solid forms can cultivate mental transformation ability, and camera movements around objects can improve visual perspective-taking skills. In general, Salomon demonstrates that active exposure to media's symbol systems can enrich an individual's cognitive capabilities, to the extent that the tasks required are mentally demanding, that is, to the extent that they require those kinds of processing that are not fully automatic and that require concentration.

One problem with television as it typically exists is that it allows effortless and automatic recoding of messages into internal representations; therefore, it may be particularly attractive to the least able students. Williams, Haertel, Haertel, and Walberg (1982) conclude from their review of 23 studies that the deleterious effects of television viewing on school achievement increase most steeply in the range between moderate and heavy viewing, in terms of hours per week. Reading is a particularly taxing effort, with little meaning gained for those individuals whose reading skills are not highly automated, and for whom the mechanics of reading take up so much "cognitive space" that little capacity is left for deeper processing and elaboration to extract meaning and generate interest. The fact that television viewing is usually such a passive experience results in a vicious cycle; the least able students are the most attracted to the medium that supplies the least skill cultivation.

COGNITIVE ASSESSMENT AND THE MEDIA

There are two sides to the question of media's cognitive consequences. The negative view gives a lengthy list of minuses, including declining SAT scores (Harnischfeger and Wiley, 1976). In that connection, Schramm (1977) and Winn (1977) suggest that television's entry into the home on a large scale (circa 1950) would have had some impact on test scores appearing in the early 1960s, when children who were three years of age in 1950 reached college age. In fact, that is about the time when SAT scores began to decline. A variety of other influences can be adduced, but if this view is even partially correct, then the SAT and other

standardized tests that showed similar declines (Cleary and McCandless, 1977) can be considered cognitive assessments that have shown some of the cognitive consequences of television exposure.

The critics have no shortage of other, less quantified indicators of television's alleged malign effects. Postman (1979) cites shorter attention spans, greater tolerance for simultaneous inputs (music and television while studying, reading newspapers in class), a decreasing tolerance for delay of gratification, and declining linguistic powers in analytical and sequential thinking and in oral expression. Postman (1979) avers that television, by weakening the left brain's verbal powers and stimulating the right brain's holistic intuitive mode, has produced "people whose state of mind is somewhat analogous to that of a modern-day baboon" (p. 72). Winn (1977) points to the "zombie-like state" of the child apparently addicted to television, and a resulting hyperkinetic syndrome attributable to an inability to concentrate or delay gratification. Were it not for some more positive voices, one might be convinced that the end is near indeed.

As discussed earlier, the work of Salomon (1979) emphasizes the positive possibilities of media and demonstrates some of these in the area of visualization skills. His work focuses on using media to enhance skills. Another approach steps back from an analysis of the stimulus properties of the symbol system to an analysis of the effects of the medium itself. Since the dominant communication modes in our society are electronic media, a comprehensive cognitive assessment might well include some attention to media competence. Media competence includes content comprehension, but also a knowledge of the effects of the media themselves and how they differ from each other.

MEDIA COMPETENCE

In contrast to the considerable psychometric work over the years on language, reading, writing, and mathematics, little history of assessment in media competence exists to which one can turn (Karl, 1981; Siebert, 1970). As Karl describes, competence in media comprises verbal content skills along with a nonverbal dimension. The verbal component includes the ability to distinguish between claims and appeals; the recognition of bias; the capability to make distinctions among reports, inferences, and judgments; and the ability to determine the influence of context upon the message being carried. The nonverbal dimension includes awareness of the effects of shot composition, sound editing, motion, color, and lighting, all of which produce effects that differ significantly from print.

These and other dimensions of media competence, both verbal and nonverbal, could form the basis of a curriculum and an associated assessment approach. In a sample exercise, a class might consider an advertisement in which images of a popular soft drink and scenes of people surfing, skateboarding, playing games, and so forth alternate rapidly. As is often the case, no verifiable claims are presented, nor need they be. Nevertheless, we associate the soft drink with moments of pleasure and excitement; we have been "visually massaged" without any statements being made that are subject to the ordinary rules of logical verification. Visual images are neither true nor false; Donny and Marie Osmond just *are*. But clearly, the visual media can induce a frame of mind and can influence thought, attitudes, and behavior. The more viewers can be made conscious of media effects, and the differences between media, the more likely they will be able to make intelligent responses rather than unconscious reactions (Houk and Bogart, 1974).

Many adults now use television as their major source of news and find television news a more believable source than newspapers. Is it plausible that there is indeed more objectivity in television news than in print journalism; or is it also possible that the visual medium itself contributes to the sense of objectivity, beyond what the informational content of the message provides? Again, much of what is transmitted visually is not verifiable; it is perceived immediately and does not permit analysis in the same way as does the written word. Even the commentator's visual appearance contributes to the drama and immediacy of television news, and although it is irrelevant to the message, it is not irrelevant to the impact of the message.

Postman (1979) and others argue for the study of media ecology in order to heighten students' awareness of how media affect our thought and behavior. He holds that a new medium is always an idea disguised as a piece of machinery. The invention of the microscope and the telescope did indeed provide us with new information, but these media had a more profound impact in that they undermined completely the conception of reality and the contents of the world as medieval civilization knew them. They led to a fundamental reconceptualization of what there is to see and know, and to the idea that normally unperceived worlds exist. If it is important that students have media competence and an understanding of media's ecology, then a need for assessing that competence follows naturally. Postman (1979) asserts that recognizing the importance of teaching some aspects of the curriculum often follows their assessment by standardized tests: "A standardized test represents an educational thesis. It is in no sense a neutral evaluation. It does not just measure. It tells us what to measure . . ." (p. 220). Yet, the pervasiveness of electronic media and their likely cognitive effects make a strong case a priori for considering the advisability and feasibility of assessing media competence.

Karl (1981) reviews the nature of media competence and the rationale for including it in both curriculum and assessment. Schools should involve students in critical examination of the new communications media for the same reasons that led them to teach reading, namely to prepare the young to cope with the dominant media of communication in their society. Ample evidence now exists that electronic media have displaced print as the dominant forms of mass communication.

Karl (1981) makes a number of suggestions that might form the basis of an approach to assessment development. He suggests dealing with both television advertising and program material, since they share many of the unique features of the visual media. Postman (1979) has observed that the only difference between advertisements and programs on television is that the commercials are not listed in *TV Guide*. In the case of commercials, Karl suggests that students confronted by an advertisement with no verbal claims be asked to explain how its selling message is communicated. As another example, they could be asked to evaluate a commercial for a nonessential and possibly harmful product, and explain its appeal.

Assessing students' understanding of the rhetoric of camera and sound would be at least as important as verbal understanding in this context. "The connotations of a shot in a sequence of shots can be as powerful as the connotations of a word in a sentence" (Karl, 1981, p. 149). Students should be able to recognize and explain the possible meanings and effects created by, for example, the distance between viewer and subject, the angle between camera and subject (above or below), lighting and color tones, the speed of the action, transitions from one view to another, and zooms or close-ups. A screen-filling close-up of an actor suggests dominance and strength, compared with a distant shot in which the actor appears small. Similarly, a camera aimed upward at the actor conveys dominance, compared to the result when the camera is above the actor and aimed down. A news report gains credibility by showing the reporter standing before the White House, independent of the informational content of the report or its objectivity and verifiability. In one sense, the technical capabilities of electronic media make possible a wide range of biases of a nonverbalized and almost subliminal kind. However, the ability to "identify and question the views of reality which are being communicated through film or television" can be cultivated and assessed (Karl, 1981, p. 154). The willingness of networks to pay large sums of money to celebrity-status newspeople who do little more than read in front of a camera testifies to the powerful effects that nonverbal media symbols can have in increasing the drama and believability perceived by the viewer.

Today's students should be able to separate the medium from the message, and to recognize that the medium both provides a context for the message and transmits messages of its own. A great deal of development work remains in devising assessment techniques to tap media competence, but the importance of the media in the modern information environment makes such development efforts timely.

ASSESSMENT VIA MEDIA

How can we respond with research and development efforts that incorporate an awareness of media and their cognitive consequences? Fortunately, technological developments in computerized adaptive testing and computer-controlled videodisc systems are at a stage where dynamic visual displays can be integrated readily into assessment methodology. Several avenues of exploration suggest themselves.

1. Increasing the Face Validity of Items Dealing with Processes

Video technology can supplement the usual print and static drawings in a number of domains. Video can illustrate the interplay of processes and the growth of forms as no other medium can. Realistic video sequences depicting phenomena in physics, chemistry, geology, and other domains could be presented, with questions testing comprehension of these phenomena following. With currently available computer-controlled videodisc technology, slow motion, stop motion, and reverse motion options could be made available to the examinee to allow exploration of the material in ways not even possible with actual demonstrations. Beyond the increase in face validity, content and predictive validity might thereby be increased.

2. Testing Interpersonal Skills

Interpersonal interactions and group processes can be presented via videodisc in a brief and realistic manner, whereas print presentations would be time-consuming, cumbersome, and lacking in verisimilitude. Classroom situations, management problems, group interactions, and psychological phenomena are examples of domains that could be assessed readily and realistically using computer-controlled videodisc technology. An examinee's knowledge of theoretical principles does not necessarily imply the ability to apply them in a practical case; video technology would allow such assessment.

3. Testing the Handicapped

While presently available tests can be read to blind or dyslexic examinees or presented via audiotape, these modes still present difficulties because they put considerable strain on short-term memory. Coupling a computer to the audio version of the test would allow the handicapped examinee's test experience to parallel more closely that of the nonhandicapped examinee. Such control would allow unlimited replays of parts of the item and the alternative responses, which nonhandicapped examinees can accomplish directly by visual means. When computer-controlled testing stations become widely available, the auditory option could then be selected easily at minimal cost and with a likely gain in comparability to results obtained from nonhandicapped examinees.

4. Presenting Novel and Ill-Structured Problems

Expert problem solvers differ from novices in their ability to assimilate large masses of "surface" information into internalized categories that structure the information and provide mnemonic supports. Highly accomplished performance in a domain often entails the ability to impose structure on a complex and relatively unstructured series of

events. In "real-life" problems, the neat and orderly presentation usually found in test items is rarely encountered. Video displays offer a means to present realistic situations, complete with ambiguities, irrelevant information, and unsystematic organization, in a brief sequence that would be unwieldy or impossible in print. Problems in physics, biology, management, and other fields could be presented in this way, with examinees being asked to provide interpretations, organization of main themes, underlying principles, predictions of next events, recommended courses of action, models of the processes, and so forth. Computer-controlled video technology would allow review of the sequence as often as necessary. Considerable realism could be achieved with relatively brief presentations.

CONCLUDING REMARKS

Recognition of the media's role in assessment is timely, in view of the current availability of the technology needed to implement projects in this area. Currently, research and development efforts are underway in computerized adaptive testing and videodisc technology, although at present they do not explore the full potential of the link between the two. We are now at a stage at which projects can be proposed that exploit more fully the technological tools at hand in ways that will make cognitive assessment more comprehensive.

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